

WHAT IS CLAIMED IS:

Sub-B²

1. A lithographic method for forming a pattern in a film carried on a substrate, comprising the steps of:
- 5 depositing a film on a substrate to provide a mold having a protruding feature and a recess formed thereby, the feature and the recess having a shape forming a mold pattern;
- 10 urging the mold into the film whereby the thickness of the film under the protruding feature is reduced and a thin region is formed in the film;
- removing the mold from the film;
- processing the relief whereby the thin region is removed exposing a portion of the surface of the substrate which underlies the thin region; and
- 15 whereby the exposed portion of the surface of the substrate substantially replicates the mold pattern,
- the improvement comprising at least a portion of said protruding feature and a portion of said release have bonded thereto a release material comprising an inorganic linking group bonded to a molecular chain having release properties.

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2. The method of claim 1 wherein said release material comprises a material having the formula:



or

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RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

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M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

(n) is the valence -1 of M.

3. The process of claim 2 wherein RELEASE comprises a highly fluorinated organic group.
- 5 4. The process of claim 3 wherein said highly fluorinated group comprises a perfluorinated alkyl group.
5. The process of claim 2 wherein M is Si.
- 10 6. The process of claim 2 wherein X is halogen.
7. The process of claim 2 wherein X is chloro or bromo.
8. The process of claim 6 wherein M is Si.
- 15 9. The process of claim 7 wherein M is Si.
10. A process for improving the release properties of a surface comprising:
 - 20 a) providing a surface;
 - b) contacting that surface with a release forming material wherein said release forming material comprises a material having the formula:

$$\text{RELEASE-M(X)}_{n-1}-$$

$$\text{or}$$

$$\text{RELEASE-M(OR)}_{n-1}-, \text{ wherein}$$

RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

- 35 (n) is the valence -1 of M.

11. The process of claim 10 wherein said release forming material comprises a material of the formula:



wherein

RELEASE is a molecular chain of from 4 to 20 atoms in length, which molecular chain has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br; and

(n) is the valence -1 of M.

12. The process of claim 11 wherein RELEASE comprises a highly fluorinated organic group.

13. The process of claim 12 wherein said highly fluorinated group comprises a perfluorinated organic group.

14. The process of claim 11 wherein said highly fluorinated group comprises a perfluorinated alkyl group of from 4 to 16 carbon atoms.

15. The process of claim 11 wherein M is Si.

16. The process of claim 12 wherein M is Si.

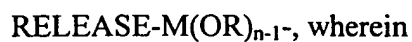
17. The process of claim 13 wherein M is Si.

18. The process of claim 14 wherein M is Si.

19. A surface having good antiadherent properties comprising a surface having bonded thereto the residue of material of the formula:



or



RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

5 X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

(n) is the valence -1 of M,

10 said material being bonded to said surface only through a bond directly to M where a group X or OR has been removed to enable bonding to said surface, with the group RELEASE still attached to M.

20. The surface of claim 19 wherein said material comprises a material of the formula:

15 RELEASE-M(X)_{n-1}-
wherein

RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br; and

(n) is the valence -1 of M.

25 21. The surface of claim 20 wherein RELEASE comprises a highly fluorinated group.

22. The surface of claim 21 wherein said highly fluorinated group comprises a perfluorinated group.

30 23. The surface of claim 22 wherein said highly fluorinated group comprises a perfluorinated group of from 4 to 16 carbon atoms.

24. The surface of claim 20 wherein M is Si.

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25. The surface of claim 21 wherein M is Si.

26. The surface of claim 22 wherein M is Si.

5 27. The surface of claim 23 wherein M is Si.

28. A surface having good antiadherent properties comprising a surface having bonded thereto the material of the formula:

RELEASE-M(X)_{p-2}

10

or

RELEASE-M(OR)_{p-2}, wherein

RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

15

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

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p is the valence of M,

said material being bonded to said surface only through a bond directly to M.

29 The surface of claim 19 wherein the surface comprises a patterned mold surface.

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30. The method of claim 1 including heating the thin film to a temperature to allow sufficient softening of the film relative to the mold prior to the step of urging.

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31. The method of claim 1 wherein the feature on the mold is formed from material selected from the group consisting of: semiconductors, dielectrics, metals, ceramics, polymers and their combination.

32. The surface of claim 19 wherein said surface comprises a material selected from the group consisting of: semiconductors, dielectrics, metals, ceramics, polymers and their combination.

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33. The method of claim 1 wherein the step of processing comprises reactive ion etching.

34. The method of claim 1 including repeating the steps of obtaining a mold, urging, removing, and processing to form a multilayered device.

35. The method of claim 9 wherein the material is selected from the group consisting of semiconductors, dielectrics, metals, ceramics, polymers, and their combination.

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36. A lithographic method for forming a pattern in a film carried on a substrate, comprising the steps of:

obtaining a substrate having a release coating thereon formed by the reaction of a compound of the formula

RELEASE-M(X)_{n-1}-

or

RELEASE-M(OR)_{n-1}-, wherein

RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from 6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

R is hydrogen, alkyl or phenyl, preferably hydrogen or alkyl of 1 to 4 carbon atoms; and;

(n) is the valence -1 of M,

depositing a film on the substrate;

obtaining a mold having a protruding feature and a recess formed
thereby, the feature and the recess having a shape forming
a mold pattern;

urging the mold into the film creating a thickness contrast pattern in the
film;

removing the mold from the film; and

transferring the thickness contrast pattern in the film onto the substrate.

37. A process for improving the release properties of a surface comprising:

a) providing a surface;

b) contacting that surface with a release forming material
wherein said release forming material comprises a material
having the formula:



RELEASE is a molecular chain of from 4 to 20 atoms in length, preferably from
6 to 16 atoms in length, which molecule has either polar or non-polar properties;

M is a metal or semimetal atom;

X is halogen or cyano, especially Cl, F, or Br;

Q is a hydrogen or alkyl group,

m is the number of Q groups,

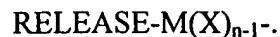
n-m-1 is at least 1, and

n is the valence -1 of M.

38. The process of claim 2 wherein said release material comprises a material
having the formula:



39. The surface of claim 28 wherein said release material comprises a material
having the formula:



40. The process of claim 38 wherein M is Si;

X is halogen Cl or Br;

RELEASE is perfluoroalkyl of 6 to 20 carbon atoms;

and

n is 3.

41. The surface of claim 39 wherein M is Si;

X is halogen Cl or Br;

5 RELEASE is perfluoroalkyl of 6 to 20 carbon atoms
and
n is 3.

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